Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Expanding Flexible Use of the 3.7 to 4.2 GHz Band	)	GN Docket No. 18-122
	)	

To: The Commission

COMMENTS OF
AEROSPACE INDUSTRIES ASSOCIATION

The Aerospace Industries Association ("AIA") hereby responds to the Federal Communication Commission's Public Notice ("PN")[1] seeking comments on a forthcoming FCC report to Congress addressing the feasibility of expanded flexibility for wireless systems in frequency bands between 3.7 and 4.2 GHz.

The AIA is the nation's most authoritative and influential voice of the aerospace and defense industry. AIA represents more than 100 leading aerospace and defense manufacturers, along with a supplier base of nearly 200 associate members, all of which supports over 2.4 million U.S. jobs. The Association's members are concerned with a critical issue implicated by the PN resulting from the MOBILE NOW Act: the public safety importance of protecting aeronautical communications and safety services operating in the 4.2-4.4 GHz frequency band from harmful interference resulting from commercial wireless operations as proposed in the immediately adjacent 3.7-4.2 GHz band. AIA's comments will address the high-level impacts of such harmful interference on aviation safety and the aviation economy. We expect our member companies who are studying this issue in greater technical detail to provide separate comments going into greater

[1] *Office of Engineering and Technology, International, and Wireless Telecommunications Bureaus Seek Comment for Report on the Feasibility of Allowing Commercial Wireless Services, Licensed or Unlicensed, to Use or Share Use of the Frequencies Between 3.7-4.2 GHz*, Public Notice, DA 18-446 (rel. May 1, 2018).

depth. AIA provides these comments to assist the Commission in determining what to study per the request of Congress in the MOBILE NOW Act.[2]

The MOBILE NOW Act directs the Commission to prepare a report on the usage possibilities of the 3.7-4.2 GHz band for commercial wireless services. In such a report, the Commission must consider not only the significant current uses of the 3.7-4.2 GHz band for satellite services, but also the impact on critical systems that either currently exist or are being developed and deployed using frequencies immediately adjacent to the 3.7-4.2 GHz band. Of particular note are wireless avionics intra-communications ("WAIC") systems and aircraft radio altimeters which are essential to aviation safety and are authorized to operate in the immediately adjacent 4.2-4.4 GHz band. Any services permitted by the Commission to operate in the 3.7-4.2 GHz band must be sufficiently restricted to ensure radio altimeters and WAIC systems are adequately protected from harmful interference. As explained below, impacts on the safe operation of radio altimeters has a cascading effect on the entire aviation ecosystem, putting the millions of daily passengers in American skies at risk.

I. THE COMMISSION MUST ENSURE THE PROTECTION OF THE FLYING PUBLIC AND THE SAFE OPERATION AND LANDING OF AIRCRAFT

Due to its high availability and superior qualities compared to other bands in the face of weather issues, the 3.7-4.2 GHz band represents a band that is important to the aviation community. Such uses include providing redundancy, weather distribution, and backhauling of aviation data. Some aviation operations also receive direct data from the National Weather

[2] *See* Consolidated Appropriations Act, 2018, P.K. 115-141, Division P, the Repack Airwaves Yielding Better Access for Users of Modern Services (RAYBAUM'S) Act. Title VI of the RAYBAUM'S Act is the Making Opportunities for Broadband Investment and Limiting Excessive and Needless Obstacles to Wireless ACT or MOBILE NOW Act.

Service for use in weather product generation by private sector meteorologists via the commercial satellite-delivered NOAAPort system that operates in the 3.7-4.2 GHz band. The aviation community depends on commercial satellite operators to provide these services. Changes to the band that would impact a commercial satellite operator's ability to provide these services would therefore have a direct impact on the aviation community.

Globally, the 4.2-4.4 GHz band is allocated to the aeronautical radionavigation service exclusively for the use of radio altimeters.[3] Radio altimeters are an essential component of the safe operation of aircraft, supporting precision approach, landing, ground proximity, and collision avoidance systems.[4] Radio altimeters operate by transmitting radio signals toward the ground and calculating the amount of time it takes for the signals to be reflected back to the aircraft receiver.[5] Using the velocity of these radio signals, along with the amount of time the signals travel, the altimeter is able to make these calculations based on the relationship of distance, speed, and time, and can accurately determine the aircraft's altitude.

All commercial aircraft are equipped with radio altimeters that operate continually during flight, with larger aircraft utilizing multiple radio altimeters.[6] This data is essential to the safe operation of the Automatic Flight Control System during automated approaches and landings.[7] In many aircraft, the radio altimeter is also directly connected to the Ground Proximity Warning System, which is warns the pilot if the aircraft is flying too low or descending too quickly, thereby augmenting the aircraft's safety systems further.[8]

[3] *See* 47 C.F.R. § 2.106, notes 5.438 and US261 (indicating that "[u]se of the band 4200-4400 MHz by the aeronautical radionavigation service is reserved exclusively for radio altimeters installed on board aircraft and for the associated transponders on the ground").
[4] *See* Operational and technical characteristics and protection criteria of radio altimeters utilizing the band 4 200-4 400 MHz, Recommendation ITU-R M.2059-0, at 1, 3 & 5 (2014).
[5] *See id.* at 5.
[6] *See id.* at 11.
[7] *See id.* at 5.
[8] *See id.*

Radio altimeters require access to the entire 4.2-4.4 GHz band, as the accuracy of the resulting altitude data is directly related to the total available bandwidth of the radio altimeter's signal.[9] Accurate and reliable altitude data is vital for safe flight. Because most radio altimeters operate at relatively low power,[10] there an interference concern with respect to ground-based radio transmitters operating near the 4.2-4.4 GHz band. Such transmitters operate at relatively stronger power, and if directed upwards, could overpower the relatively weak radio altimeter signals that have been reflected off the ground. This would prevent their reception by radio altimeter receivers on aircraft. Although radio altimeters employ band pass filters, due to physical constraints, these filters have limited ability to reject transmissions close to the 4.2-4.4 GHz band.[11] As a result, altimeter performance may be adversely affected by any signals of sufficient strength transmitted near the edge of the 4.2-4.4 GHz band.[12]

Additionally, with the active support of the United States, the 2015 World Radiocommunication Conference ("WRC-15") allocated the 4.2-4.4 GHz band on a global co-primary basis to the aeronautical mobile (route) service ("AM(R)S") exclusively for WAIC systems.[13] WAIC equipment is being deployed on new aircraft to increase the safety and efficiency of their operations by replacing portions of aircraft wiring through the use of onboard short range wireless systems.[14] WAIC systems improve aircraft safety by providing

[9] *See id.* at 11 (explaining that "radio altimeters operate in wide bandwidths to achieve the necessary accuracy levels" and therefore any reduction in the available frequency bandwidth "proportionately reduces the accuracy of radio altimeters").
[10] See id. at 12-17 (providing transmit power levels of different types of analog and digital radio altimeters).
[11] *See id.*
[12] *See id.*
[13] *See* ITU Radio Regulations No. 5.436 (indicating that use of the frequency band 4 200-4 400 MHz by stations in the aeronautical mobile (R) service is reserved exclusively for wireless avionics intra-communication systems that operate in accordance with recognized international aeronautical standards).
[14] *See, e.g.*, Presentation of the Aerospace Vehicle Systems Institute for Working Parties 5A, 5B, 5C, "Agenda Item 1.17 Wireless Avionics Intra-Communication" (May 23, 2012) (available at https://www.itu.int/ITU-R/study-groups/docs/workshop-wp5abc-wrc15/WP5ABC-WRC15-P2- 5.pdf).

dissimilar redundancy in communications links between critical aircraft systems. WAIC systems can also make aircraft more economical to operate by reducing weight compared to traditional wiring. The total weight of wiring and related fixtures on modern passenger aircraft is often in excess of six tons, so the substantial reduction in weight can improve fuel efficiency, thereby providing environmental benefits and cost savings to aircraft manufacturers, operators and the flying public.

One of the significant advantages that was identified in support of allocating the 4.2-4.4 GHz band for WAIC systems was that this spectrum is already allocated for an aeronautical safety service[15] and the spectrum has no adjacency issues with that which is currently used for mobile consumer devices such as smartphones, laptops, and tablets, which are all routinely carried by passengers on commercial aircraft and frequently used during aircraft operation. Currently, mobile consumer devices are not designed with the capability to transmit signals in or near the 4.2-4.4 GHz band, so there are no issues with WAIC systems operations. If, however, the Commission were to create an allocation for mobile wireless systems in the 3.7-4.2 GHz band, the global aviation industry would likely be forced to confront the substantial public safety problem of out-of-band emissions, including potential emissions from consumer devices onboard the aircraft, impacting the safe operation of aircraft. If mobile wireless operations were allowed in the 3.7-4.2 GHz band, these operations could result in out-of-band interference with WAIC systems in the 4.2-4.4 GHz band, which would potentially cause aircraft safety issues.

[15] WAIC systems will not interfere with radio telemetry operations in the same spectrum because the significant attenuation of aircraft "skin" protects radio altimeters from the relatively low power WAIC transmissions inside the aircraft.

II. THE COMMISSION MUST ALSO STUDY THE OUT-OF-BAND IMPACT ON AVIATION CRITICAL SAFETY-OF-LIFE SYSTEMS SUCH AS RADIOALTIMETERS AND WAIC

As described above, the 4.2-4.4 GHz frequency band is critical to aviation safety and any out-of-band interference that may originate from high density mobile services in the upper range of the 3.7-4.2 GHz band poses a significant risk.[16] Due to the critical nature of radio altimeters, particularly during takeoff and landing, interference in the 4.2-4.4 GHz band presents risk to safety-of-life operations for the aircraft that carry nearly 900 million passengers each year in the U.S.[17] The Commission must do everything possible to mitigate these risks as it examines the flexible use of the 3.7-4.2 GHz band.

To that end, prior to making any allocations for high density mobile services within the 3.7-4.2 GHz band, the Commission along with the aerospace industry should examine the impacts on the above-mentioned systems in order to minimize risk to the flying public. Such a study examining the impacts of out-of-band interference must be thorough and comprehensive in order to reliable address the magnitude of risks posed by potential interference issues from the 3.7-4.2 GHz spectrum to the 4.2-4.4 GHz spectrum

[16] While these comments primarily consider immediate impacts of wireless system services on radio altimeter operations, AIA highlights that additional critical services could be compromised. Specifically, potential impacts to the second harmonic of GPS L2 signals and to the third harmonic of the IFF receive signal are possible, depending on the harmonic effects of wireless system RF out-of-band allowable emissions, and also warrant close study.

[17] *See* The Economic Impact of Civil Aviation on the U.S. Economy, Page 4, accessible at https://www.faa.gov/air_traffic/publications/media/2016-economic-impact-report_FINAL.pdf

III. CONCLUSION

AIA recognizes the Commission's goal of identifying additional spectrum suitable for flexible usage for high density mobile services. The Commission, however, must ensure that any additional use of the 3.7-4.2 GHz band adequately protects not only in-band satellite services, but aeronautical communication and safety systems operating in the adjacent 4.2-4.4 GHz band. Failure to do so impacts safety-of-life operations for all aircraft, and could potentially result in a catastrophic loss-of-aircraft situation due to wireless spectrum interference issues.

Respectfully submitted,

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